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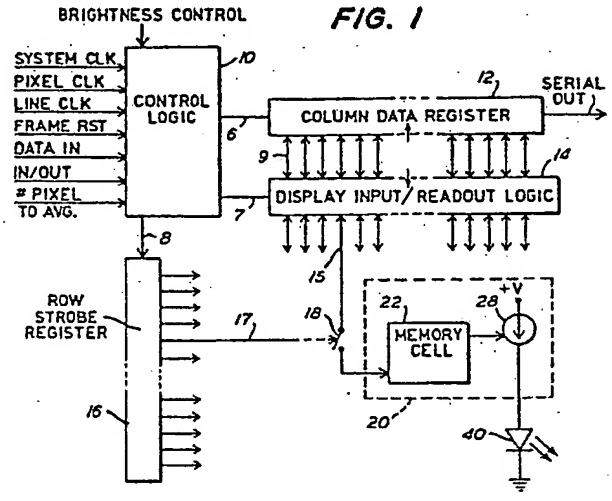
(54) Electroluminescent storage display with improved intensity driver circuits.

(57) In the present invention a matrix array of organic electroluminescent storage display elements along with row and column selection circuitry (12, 14, 16) are used to select the particular display elements (40) within the matrix to be illuminated. Interposed between the column and row selection electronics are a plurality of memory cells (22) receiving as inputs bit values (B_n-B_o) that correspond to the desired intensity requested from a display element (40). The memory cells (22) output activation signals which drive corresponding MOS switches (24) each of which in turn is parallel connected as part of a current driver source (28) feeding a single display element (40). Activation of one or more of the MOS switches (24) provides a controlled amount of current to be applied to the display element (40) to in turn provide a related amount of light from the display element (40).

FIG. 1



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respect to the positive potential of layer 42. The device thus formed is an organic electroluminescent diode which is responsive to d.c. to provide a light output. Such a device is described in detail in an article entitled "Organic Electroluminescent Diodes" by C.W. Tang, Appl. Phys. Lett. 51(12), 21 September 1987, pps 913 and 914.

To form a large scale display a plurality of these elements can be positioned together in a frame type structure or they may be fabricated as either a single or as separate VLSI chips which are interconnected to form the display.

Claims

1. An electroluminescent storage display with improved intensity driver circuits characterized by:
an electroluminescent element (40);
a plurality of memory elements (22);
a current source (28) connected in circuit to said electroluminescent element (40);
a plurality of elements (24), corresponding in number to said plurality of memory elements (22), each connected to a respective memory element (22) and responsive to the signals stored therein for causing an incremental current to flow from said current source (28) to said electroluminescent element (40); and
means (10, 12, 14, 16, 18) for applying signals (B_n-B_o) to said memory elements (22) indicative of the intensity desired from said electroluminescent element (40).

2. The electroluminescent storage display of claim 1 wherein said plurality of elements (24) are MOS transistors each having a gate electrode connected to a respective memory element (40).

3. The electroluminescent storage display of claim 1 wherein said means for applying signals to said memory elements is comprised of: a plurality of binary bits (B_n-B_o) corresponding in number to said plurality of memory elements (40) and an enabling signal source for providing an enabling signal (16) for loading said binary bits (B_n-B_o) into said memory elements (40).

4. An electroluminescent storage display with improved intensity driver circuits characterized by;
a column data register means (12) having an input (6) for serially receiving image signals, and having a plurality of parallel outputs (9) for providing said image signals thereon;
an input/output logic means (14) responsive to an enable signal (7), and coupled to the plurality of parallel outputs (9) of said column data register means (12) for gating said image signals to respective column outputs (9);
a row strobe register means (16) responsive to an input signal (8) for sequentially providing an enabling strobe signal on each of a plurality of row outputs (17);
a plurality of switch means (18), each connected to a respective one of a plurality of row outputs (17) of said row strobe register means (16) for connecting a respective one of said column outputs (15) of said input/output logic means (14) to a switch output;
a plurality of memory driver circuit means (20) having an input connected to the switch output of a respective switch means (18) and having an output for providing a current as a function of the image signal received on its input; and
a plurality of electroluminescent display means (40) each connected to an output of a respective memory driver circuit means (20) for illumination by the provided current therefrom.

5. An electroluminescent storage display according to claim 4 and further comprising:
a control logic means (10) responsive to input control signals, image data signals and brightness signals for providing image signals to said column data register (12), enable signals (7) to said input/output logic means (14), and an input signal (8) to said row strobe register means (16).

6. An electroluminescent storage display according to claim 4 wherein each of said plurality of memory driver circuit means (20) is comprised of:
a plurality of memory elements (22);
a current source (28) connected in circuit to an electroluminescent display means (40);
a plurality of elements (24) corresponding in number to said plurality of memory element (22), each connected to a respective memory element (22) and responsive to the signals (B_n-B_o) stored therein for causing an incremental current to flow from said current source (28) to said electroluminescent display means (40); and additionally
means (16, 12, 14) for applying signals to said memory elements (22) indicative of the intensity desired from said electroluminescent display means.

7. The electroluminescent storage display of claim 6 wherein said plurality of elements (24) are MOS transistors each having a gate electrode connected to a respective memory element (22).

8. The electroluminescent storage display of claim 6 wherein said means for applying signals to said memory elements is comprised of:
a plurality of binary bits (B_n-B_o) corresponding in number to said plurality of memory elements (22) and an enabling signal source (16) for providing an enabling signal (ROW) for loading said binary bits (B_n-B_o) into said memory elements (40).

9. an electroluminescent display matrix characterized by:
a plurality of electroluminescent elements (40) arranged in a display;

a plurality of storage means (22) for each of said plurality of electroluminescent elements (40) for receiving binary number signals (B_n-B_o) corresponding to the intensity level desired from an associated electroluminescent element (40);

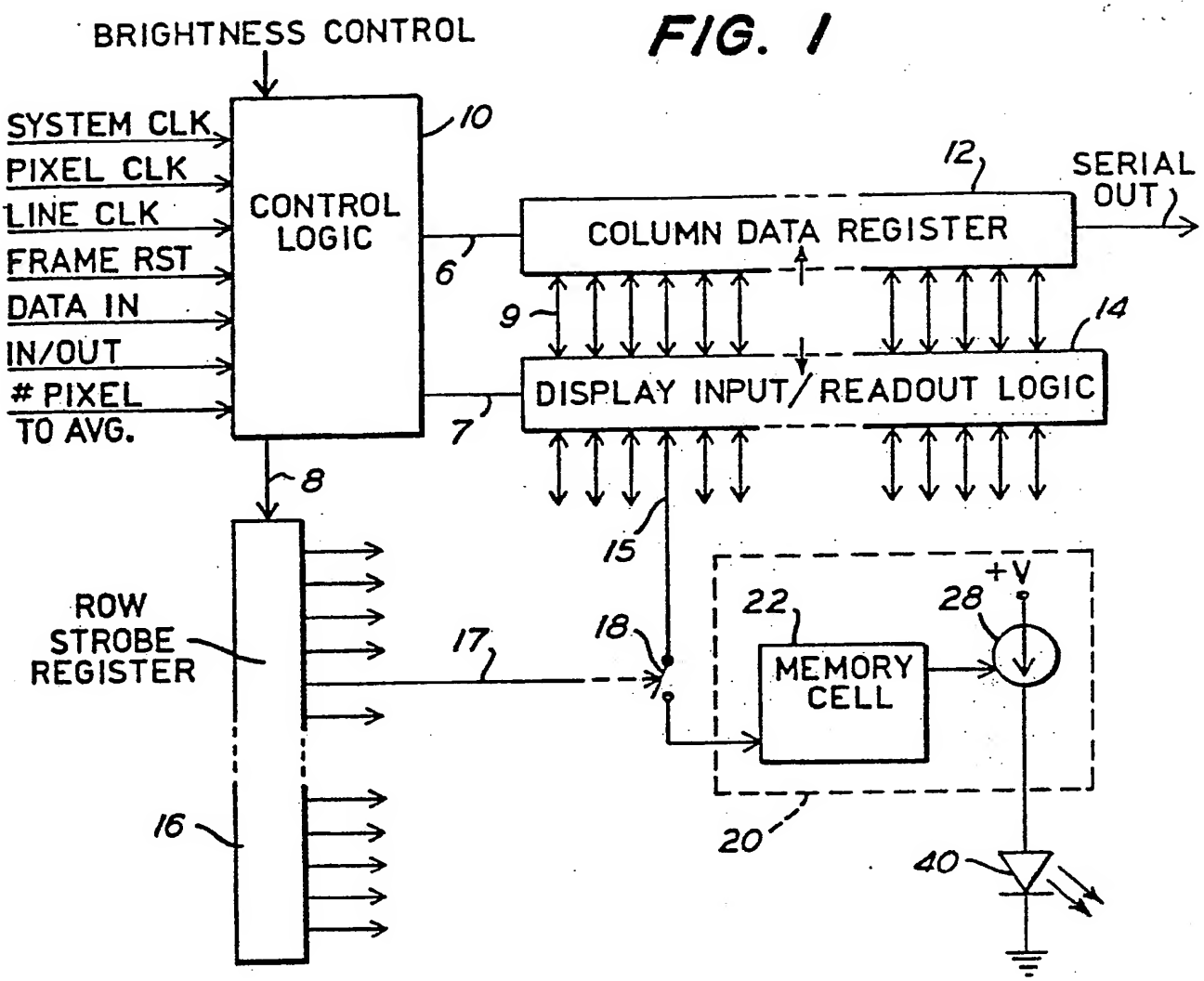
a plurality of current sources (28) each coupled to a respective plurality of said storage means (22) and an associated electroluminescent element (40) for providing a current as a function of the binary number signals (B_n-B_o) stored in said storage means (22).

10. The electroluminescent display matrix according to claim 9 wherein each of said plurality of current sources (28) is comprised of:

a two MOS device current mirror (26, 27), with the first of said MOS devices (27) connecting said electroluminescent element (40) to a source of power (+V) and with the second of said MOS devices (26) connecting said source of power to a selectable current means (24); and

a selectable current means (24) connected to said plurality of storage means (22) and responsive to the signals stored therein for causing the current in said second MOS device (26) to be a function of the signals (B_n-B_o) stored in said plurality of storage means (22).

FIG. 1


BRIGHTNESS CONTROL
SYSTEM CLK
PIXEL CLK
LINE CLK
FRAME RST
DATA IN
IN/OUT
PIXEL TO AVG.
CONTROL LOGIC
10
12
SERIAL OUT
COLUMN DATA REGISTER
6
9
14
DISPLAY INPUT/READOUT LOGIC
7
8
15
ROW STROBE REGISTER
17
18
22
28
+V
MEMORY CELL
20
16
40

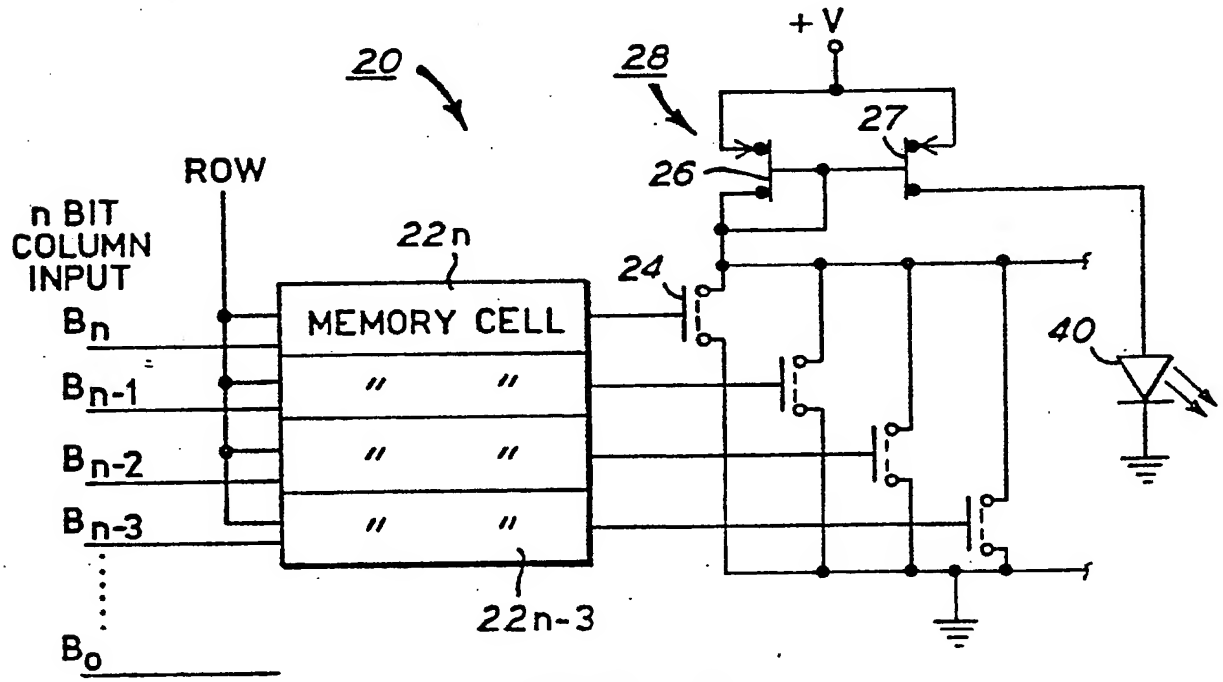

20
28
+V
27
26
ROW
n BIT COLUMN INPUT
22n
24
MEMORY CELL
40
Bn
Bn-1
Bn-2
Bn-3
Bo
22n-3

FIG. 2

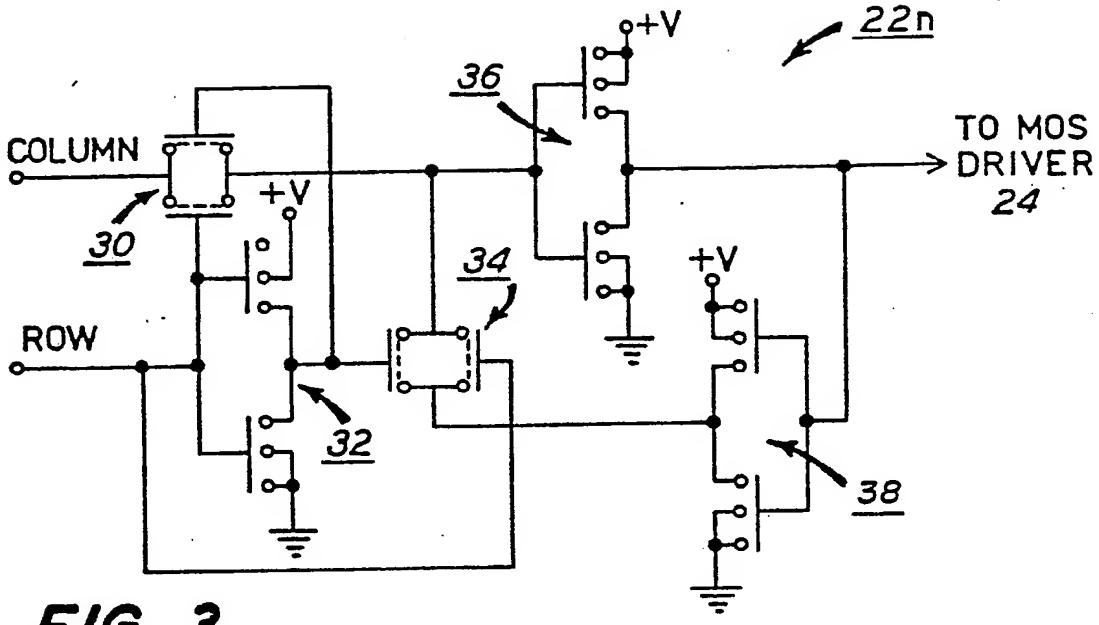


FIG. 3

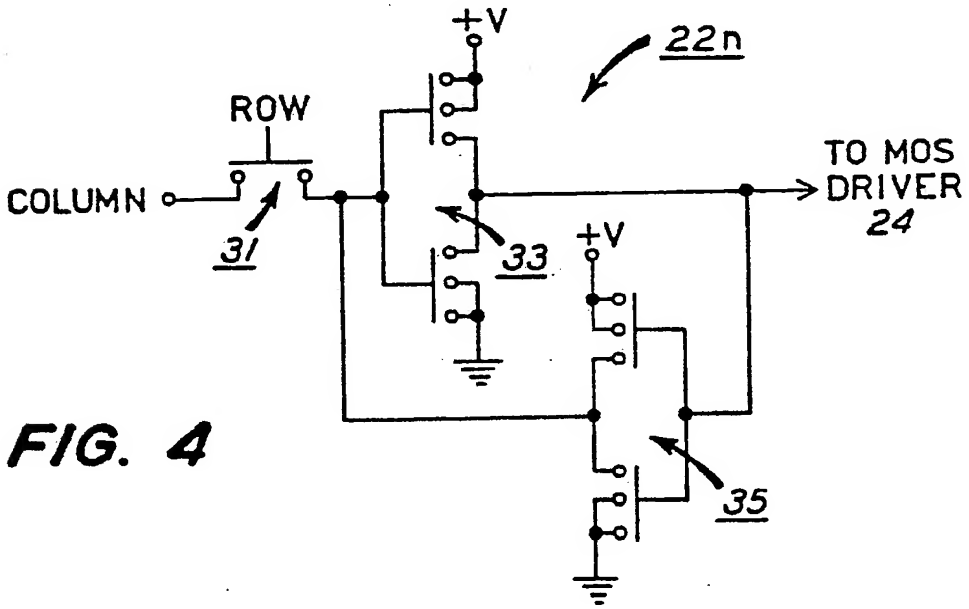
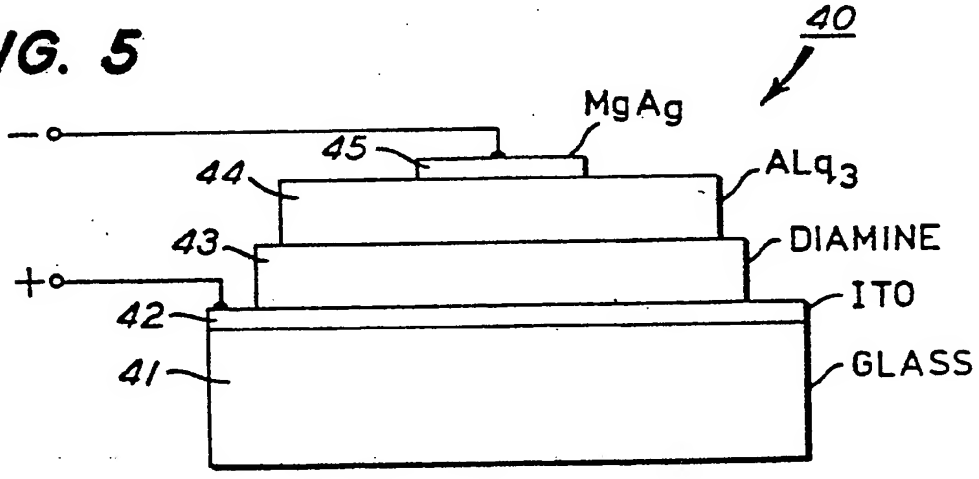


FIG. 4

FIG. 5



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13.06.90 Bulletin 90/24

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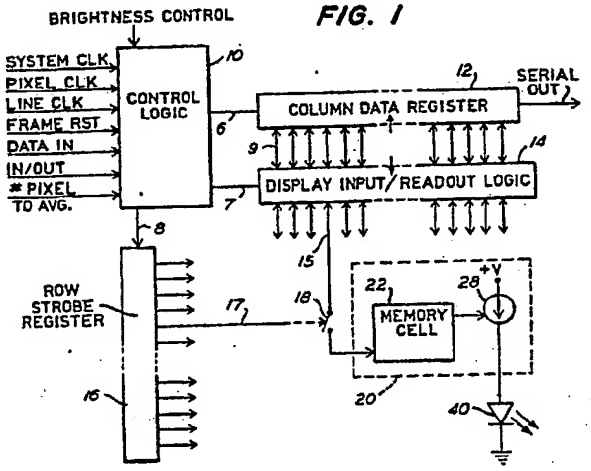
FIG. 1



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EUROPEAN SEARCH REPORT

Application Number

EP 89 42 0391

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 740 570 (G.R. KAELIN et al.) * the entire document * ---	1,4,5,9	G 09 G 3/32
A	US-A-3 629 653 (M. IRWIN) * the entire document * ---	1,4,5,9	
A	US-A-4 559 535 (R.W. WATKINS et al.) * column 7, line 41 - column 10, line 66; figures 6-10 * -----	1,4,5,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G 09 G
H 04 N
H 05 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	01-03-1990	KELPERIS K.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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